Activity Levels of Slender Lorises in a Captive Environment

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Abstract

The behavior of animals in captivity can supplement studies conducted in the wild, as well as contribute to our understanding of animal reactions in captive conditions. Captive animals must adapt to different conditions than those found in the wild, and therefore may be influenced by the presence of human guests. In this study, the behavior of slender lorises at the Memphis Zoo was recorded over a period of six weeks. Activity budgets of each animal were notated using accepted sampling methods. In addition, two factors were observed for possible influence on slender loris behavior. Both the number of guests present in the exhibit, as well as average decibel levels in the building were recorded. Results were examined for correlational relationships among the variables, but no conclusive findings were determined. There does not appear to be a positive or definitive correlation between activity level and guest presence, or activity level and noise levels. There were a number of factors that could have influenced results, however, and further research is needed to make any positive determinations.

Introduction

The study of animals in captivity can provide vital insights when it comes to garnering information about natural behaviors. Many of the behaviors found in captivity mirror those in the wild. No captive environment can reproduce the experience in the wild; yet, by studying behavior in captivity, it is often possible to note issues and make changes in the exhibit space or husbandry practices which might result in improvement of the quality of life for the captive animals.

Slender lorises are one of the rarest species currently found in captivity, as well as in the wild (Fuller et al., 2013; Mittermeier et al., 2006). They were first exhibited in North America in the Bronx Zoo in 1900, and numbers have varied over the years (Fitch-Snyder & Schulze, 2001). The last two decades in particular have seen a dramatic decrease in the number of lorises found in accredited zoos in North America; nearly twenty years ago, it was estimated that there were about 70 animals in captivity (Schulz & Meier, 1995). Currently, there are only 7 slender lorises found in accredited zoos in North America (A.J. Saunders, personal communication, October 4, 2014). Five of those are found in the Memphis Zoo, in the Animals of the Night exhibit.

Slender lorises are notoriously sensitive when it comes to a number of factors in their captive environments. They are highly susceptible to stress, which can result in diet and activity disruption, making them more vulnerable to illnesses; in some cases, this has even induced seizures and contributed to death (Ablard, 2006; Fitch-Snyder & Schulze, 2001; Schulz & Meier, 1995).

This study investigates how slender loris activity and stress levels may be affected by noise levels and guest presence at the Memphis Zoo. There is no definitive measure of stress among animal behaviorists, but primatologists and those in particular studying prosimians and lorises have made some determinations about what constitutes stress and stressful behaviors in these particular animals, both in the wild and in captivity (Schulz & Meier, 1995). Some stress behaviors have been noted in predator defense postures and reactions (Nekaris et al., 2007).

Methods

This study was conducted at the Memphis Zoo in Memphis, Tennessee, USA, in the Animals of the Night exhibit. There are 22 separate exhibit spaces in this building, as well as 12 off-exhibit holding areas, with 26 different nocturnal animal species present in the building at the time of this publication. The particular exhibits observed in this study were in three different areas of the building. Two of the exhibits were exposed to the public; they were triangular-shaped, with two sides being clear glass and the third being blacked out solid. Each of these exhibits had a male-female pair of lorises. The third observed area was in an area not accessible to the public, and contained a solitary female individual (See Appendices A and B for photos).

The exhibits meet or exceed recommendations for the species. The light cycle is approximately 12 hours on, 12 off, with a reverse-light cycle wherein lights go off at approximately 1030 hours, and come back on at approximately 2230 hours. Only red bulbs are used in the exhibits' night lighting; this is less harsh on nocturnal animals' eyes (Finley, 1959). The minimum recommendations for enclosure height are 2.0-2.5 m; the Memphis Zoo public exhibit heights are 2.3 m and the behind-the-scenes den enclosure is 1.9 m. Minimum recommendations for overall space vary widely, from 1.5 m^3 to 16 m^3. The public exhibits are 24.8 m^3 each, while the den enclosure area is 2.7 m^3 (Schulze, 2001). All 3 enclosures exhibit a high quality use of space: there is dense branching and foliage, use of live plants, numerous nesting boxes and hide spaces, and a variety of feeding stations offered (See Appendix A for photos). The quality of space in lorisid exhibits has been shown to have a much greater effect on behavior than amount (Fuller et al., 2013).

The study was conducted over six weeks; the researcher visited the Memphis Zoo for 1-2 days every week and made observations at each of the 3 exhibits holding lorises (except during nighttime/after-hours sessions, when going behind-the-scenes was not allowed; in this case, only the public-accessible exhibits were visited). Observations were made for one hour at each exhibit, between 0800 hours and 2000 hours. Twenty-seven hours of observation were undertaken for this particular project. Animals with public exhibits were observed from immediately outside the glass, albeit with the researcher attempting to remain out of sight of the lorises; this was not always possible with the angle of the exhibits. Animals in exhibit 1 appeared to be somewhat habituated to observer presence. Animals in exhibit 2 appeared to be well-habituated to observer presence, and would actually seek out the observer at times if spotted and come right up to the glass to peer out or follow the observer at times. The individual in the off-exhibit non-public den enclosure was observed from outside the wire of its living area; habituation in this particular case proved extremely difficult. This animal was known to have a particularly timid demeanor, both from its previous institution's keepers and veterinarian, as well as the fact that it had been placed on exhibit at one time, but had stopped eating and lost weight, concerning the keepers and resulting in the animal being pulled to an off-exhibit area indefinitely (C. Krenn, personal communication, August 28, 2014).

Number of guests that walked by each exhibit was tracked in the public exhibits. Additionally, in all 3 exhibits, sound levels were tracked using a BAFX Products (TM) - Decibel Meter / Sound Level Reader. Readings were taken several times a minute, with high and low sound levels recorded. Sound tracking did not begin until after the third observational session. After taking measurements both inside and outside of the exhibit, it was shown that exhibit glass lowered decibel levels inside the exhibit to about 10 decibels lower than those outside the exhibit.

The study started out with ad-libitum sampling, or recording freehand notes of all individuals and their behaviors in the pre-specified time. This helped to get an idea of the individual behaviors and interactions to expect from each specimen, as well as provided practice in observing practices. Then, the researcher moved on to scan sampling, or instantaneous point sampling. This type of sampling records activity or behavioral states of all animals in a group at predetermined intervals – in this case, at one-minute intervals (Altman, 1984; Clarke, n.d.; Martin & Bateson, 2007). There were therefore 2,501 sample points for this study (549 for each of the four specimens in the public exhibits, and 305 for the behind-the-scenes individual).

Five individuals were observed during this study. The individuals in the pairs were easily distinguishable, as in both cases, the females were significantly larger than the males. This is a small sample size, but some other researchers have managed to make extrapolations from similar sample sizes in primate studies (Fernandez-Duque, de la Iglesia, & Erkert, 2010; Nekaris, 2001).

The behaviors recorded were Movement, Inactive, Forage/Feed, Allogroom, Self-groom, Breed, and Other. Movement consisted of any type of locomotion, including walking, running, stalking, and climbing. Inactive indicated that an animal was at a standstill; it might be awake, or looking around, but no major bodily movement was observed. Forage/Feed included any behaviors such as digging, sniffing, looking, or sifting in food bowls, capturing live insects, or actually consuming any of their food. Allogroom behaviors occurred when an animal was either grooming or being groomed by a conspecific. Self-groom occurred when an animal groomed itself in any way. Breed included any breeding behaviors such as mounting, thrusting, grasping from behind in a breeding position, and females allowing males to breed. Behaviors in the Other category consisted primarily of urine-washing and scent-marking in any way (urinating on hands and feet, and rubbing those hands and feet on branches or enclosure features, as well as urinating while dragging genitalia on branches or enclosure features).

Results

The results of this study could not produce any definitive conclusions that the number of guests present or noise levels significantly affect the activity levels of slender lorises in this particular captive situation.

A Pearson's r correlation was used to look at the data from this study. Using the formula

$$\mathrm{r} = \frac{\mathrm{n}(\sum xy) - (\sum x)\ (\sum y)}{\sqrt{[\mathrm{n}(\sum x^2) - (\sum x)^2]\,[\mathrm{n}(\sum y^2) - (\sum y)^2]}}$$

wherein *x* and *y* are the variables in the study, and *n* is the number of samples, the Pearson's r coefficient was determined for the concepts of guest presence vs. activity level as well as average decibel level vs. activity level.

Animal	**Guest Presence vs. Activity**	**Decibel Level Vs. Activity**
Vyvy	0.189	0.860
Kumar	0.519	0.845
Yeu	0.124	0.577
Harold	0.232	0.430

Table 1. Pearson's r correlations. An r of +.70 or higher is considered to be a very strong positive relationship; +.40-=+.69 is considered a strong positive relationship; +.20-+.29 is considered a weak positive relationship; and +.01-+19 is considered a negligible relationship (or no relationship). Although Vyvy and Kumar show very strong positive relationships with decibel level vs. activity, and Yeu and Kumar show strong positive relationships with decibel level vs. activity and guest presence vs. activity, these numbers can be misleading, with the presence of outliers (which were present in this study).

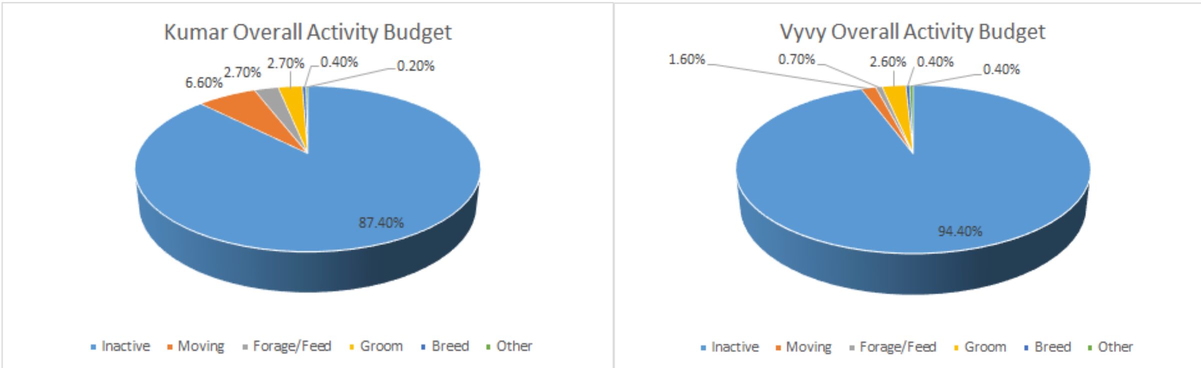

Figure 1. Exhibit #1 Activity Budgets. The male slender loris Kumar had an overall inactive time of 87.4%, while the female Vyvy had an overall inactive time of 94.4%. The remainder of their active times were divided among Movement (6.6% male, 1.6% female); Forage/Feed (2.7% male, 1.6% female), Groom (2.7% male, 2.6% female), Breed (0.4% male, 0.4% female), and Other (0.2% male, 0.4% female).

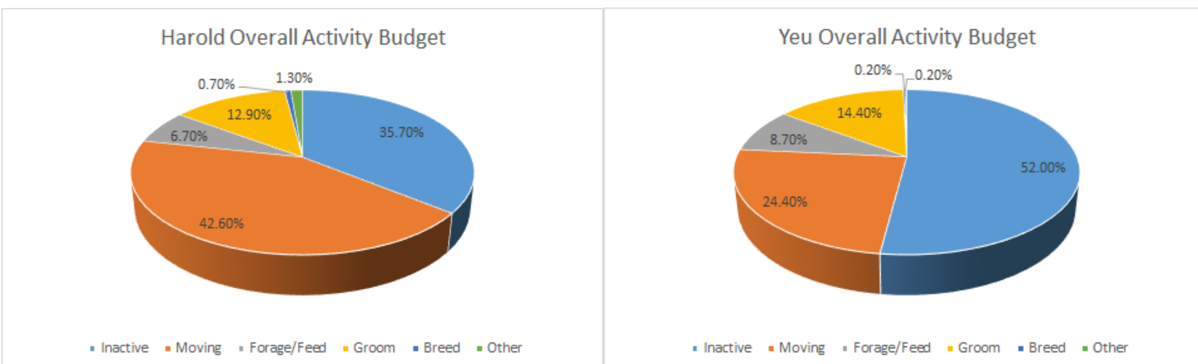

Figure 2. Exhibit #2 Activity Budgets. The male slender loris Harold had an overall Inactive time of 35.7%, while the female Yeu had an overall inactive time of 52.0%. The remainder of their active times were divided among Movement (42.6% male, 24.4% female); Forage/Feed (6.7% male, 8.7% female), Groom (12.9% male, 14.4% female), Breed (0.2% male, 0.2% female), and Other (0.2% male, 0.2% female).

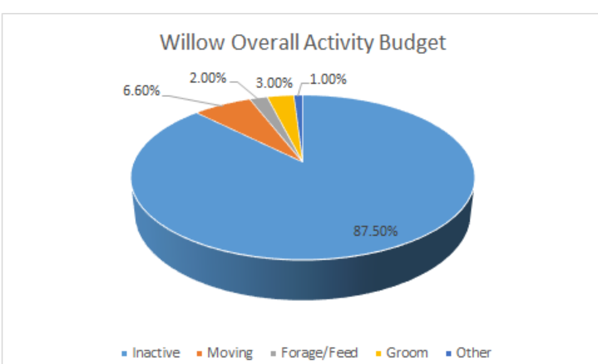

Figure 3. Den Enclosure Activity Budget. The female Willow had an overall inactive time of 87.5%. The remainder of the active times were divided among Movement (6.6%); Forage/Feed (2.0%), Groom (3.0%), and Other (1.0%).

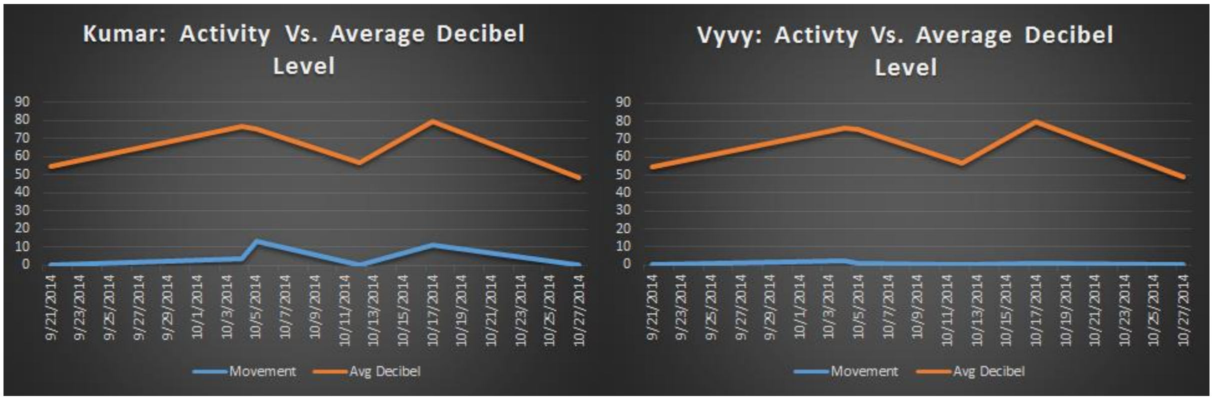

Figure 4. Activity Level versus Average Decibel Level. The male Kumar and female Vyvy in Exhibit #1 displayed lower levels of activity behaviors overall, which were not correlated with the average decibel level found in the building. Activity or Movement in this instance referred to anything other than inactivity (locomotion movement, feeding/forage, grooming, breeding, or other behaviors).*

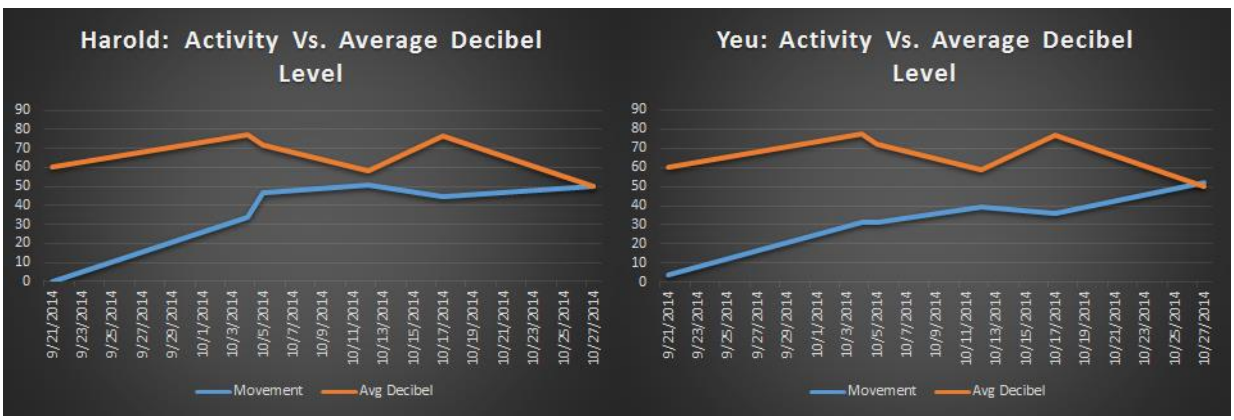

Figure 5. Activity Level versus Average Decibel Level. The male Harold and female Yeu in Exhibit #2 displayed higher levels of activity behaviors overall, which were not correlated with the average decibel level found in the building. Movement in this instance referred to anything other than inactivity (locomotion movement, feeding/forage, grooming, breeding, or other behaviors).*

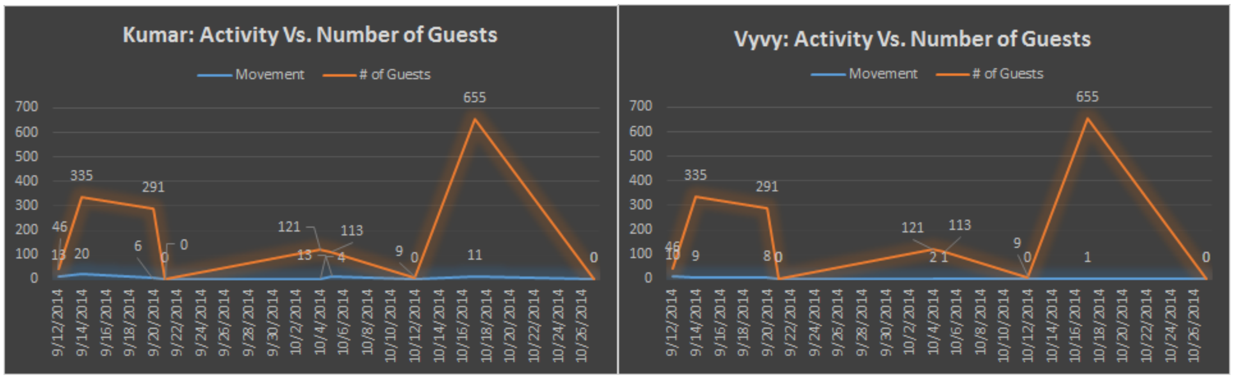

Figure 6. Activity Level versus Number of Guests. The male Kumar and female Vyvy in Exhibit #1 activity levels did not correlate with number of guests present. Activity or Movement in this instance referred to anything other than inactivity (locomotion movement, feeding/forage, grooming, breeding, or other behaviors).*

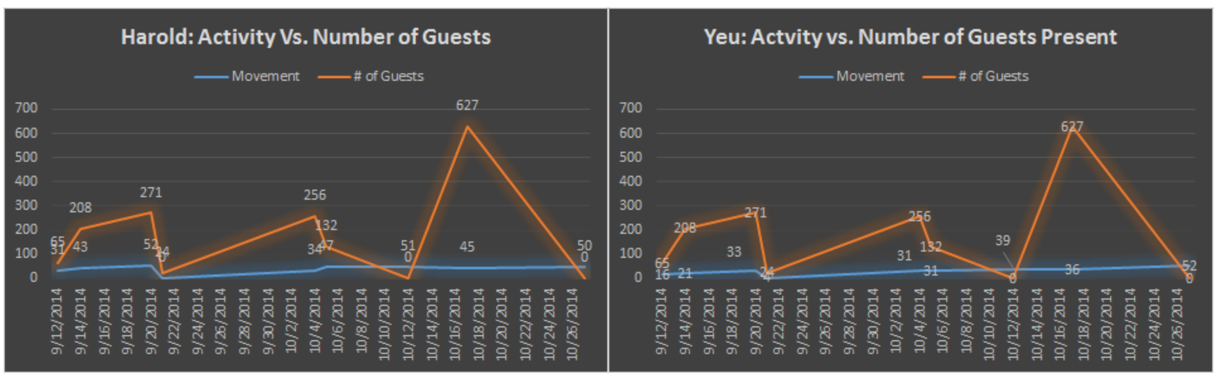

Figure 7. Activity Level versus Number of Guests. The male Harold and female Yeu in Exhibit #2 activity levels did not correlate with number of guests present. Activity or Movement in this instance referred to anything other than inactivity (locomotion movement, feeding/forage, grooming, breeding, or other behaviors).*

* Data was insufficient for the solitary female Willow to be included in these data sets.

Discussion

There were numerous factors that could affect the behavior of the animals in this study. Activity levels could be attributed to the demeanor of the individual animals; additionally, observer influence played a part. For example, the animal held in the non-public den enclosure (Willow) was far more aware of the presence of the observer. Part of this had to do with the fact that she was not behind glass, and so could definitely hear when the researcher entered or exited the service area. This animal was also known to be the one with the most timid demeanor; she had originally been in a public exhibit, but because of stress related to being on-exhibit, she stopped eating, started losing weight, and had to be moved to an enclosure with no public access

(S. Reichling, August 29, 2014). It took several sessions of observation before she was even a little habituated to the presence of the researcher, enough so to relax into “normal” behaviors. Therefore, it is possible that much of the data collected for this individual is inconclusive at best. Keepers and the researcher were aware of the possibility of this issue beforehand, and discussed how it might be overcome by the installation of a camera which would allow remote observation resulting in less stress and the presentation of more typical behaviors. However, despite this, we were unable to coordinate with administration and IT so that such a camera might be installed. This is an unfortunate reality when working as an outside researcher with an institution such as a zoo; the researcher must work within the confines of what the institution allows or has the time/resources to accommodate.

Demeanor appeared to be a substantial factor, as each loris or group of lorises exhibited the same trends in behavior. The 1.1 pair Harold and Yeu were consistently much more active than the 1.1 Kumar and Vyvy. Additionally, they were more curious when they spotted the observer, sometimes just looking back, but other times actually coming right up against the glass to peer at the observer, whereas when Kumar and Vyvy spotted the observer, they tended to freeze or hide. While efforts were made to minimize spotting, it was impossible to completely prevent the lorises sighting the researcher at all times. Harold and Yeu also utilized their exhibit space in a far more expansive manner than was observed in the other 1.2 lorises. They were the only lorises spotted to use every part of their exhibit from top to bottom, going all the way to the potted plant on the substrate (See Appendix A for exhibit/substrate photos). The other 1.1 pair consistently remained solely at the very top part of their exhibit; slender lorises are known to retreat to higher spaces when they are experiencing more stress.

It is possible that being housed in pairs may offset some of these factors and reduce stress considerably. Slender lorises were originally thought to be solitary animals when first housed in zoos, but more and more studies from the wild are showing the exact opposite to be the case, and that they in fact have their own complex social systems and interactions (Bernede, 2008; Nekaris, 2006; Radhakrishna, 2004; Radhakrishna & Singh, 2002). It would definitely be interesting to do more studies on the slender loris in the future, with perhaps more of a social slant.

The other main factor in affecting activity levels was actually noted to be more in relation to light than sound. Once the lights went off in an exhibit, there would often be a drastic change in the activity levels from light to dark. This would be an interesting topic to explore further in the future. Bearder, Nekaris, & Curtis (2006) performed a study in the wild that looked specifically at the role of vision in activity of nocturnal primates; carrying out a study with captive nocturnal primates might provide further insights.

A much more long-term study with more data collected over a longer period of time would be needed to collect a better picture of the behavioral levels of lorises year-round in these exhibits. If cameras could be installed in the exhibits, it would make observation much easier; it would minimize stress and observer bias, as well as allowing researchers to monitor multiple streams around the clock, which could increase data intake substantially.

Action and Reflection

The keepers and the curator were involved at various points throughout the process of data collection for this project. I conducted interviews with several of them to get a more complete picture of the lorises, the project, and other related information. For example, it was through a keeper interview that I found out how many slender lorises were left in captivity. This was information that they had access to that was not available to me. It correlated with what I had inferred (I did find an article citing that there were 8 slender lorises in captivity in North America, and I knew that one had died in the last year), but it was good to get definitive confirmation of the information. I also found out about the 0.1 “Willow” and her past, from being on exhibit to becoming so stressed that she had to be taken off exhibit after refusing to eat and losing weight.

The results of this study will be shared with the keepers at the zoo in a presentation by the end of December. Originally, this was supposed to occur before the end of the semester, but the zoo staff had two animal deaths, a staff change, and have had to start hand-rearing twin bushbabies, as a result of their mother dying all in the last few weeks, and therefore the presentation has been delayed. Staff at the Memphis Zoo have been very receptive to outside researchers interacting with and studying their animals, as well as presenting information on them. Even if it is information that they intuitively already know, as is often the case with animal keepers, it will be something definitive that they can look at to educate visitors or themselves, or to inform them when making future decisions in regards to these particular animals, or animals of this species, or even similar species (as they do house pygmy lorises currently, and have housed slow lorises in the past). Even though results are perhaps not conclusive statistically, zookeepers are often able to appreciate and utilize anecdotal observations and general trends extensively in their daily work. There were a number of observations that I made in my ad-libitum notes, as well as in supplemental notes throughout the study that I believe the keepers and staff would appreciate. Additionally, I will be setting up a display with some of the results of this paper in the Animals of the Night building. The keepers recently created a lighted display space where they highlight animal facts about animals in their collection; currently, for example, there is a tripod about bats. This will be the space that I utilize for my display.

I was definitely surprised by the observations I made throughout the study. When I began, I was fairly certain that external factors in the building such as guest presence and noise levels would have significant impacts on the activity levels of the lorises. While these factors cannot be completely discounted (the story of Willow serves as a pertinent example of how in some cases being on exhibit will in fact affect an animal adversely), the two pairs in this study did not appear to be appreciably affected by these factors.

When I began the study, I did not comprehend the full difficulties that would be entailed in conducting an animal behavior study. There are so many different factors when it comes to studying animal behavior. Ethology is a field where factors overlap and are interrelated, and making distinctive conclusions in any animal behavior study can be problematic at best. Throughout the course of the study, I saw where I should have started differently (such as making decibel recordings from the very first week, so that I would have more data), as well as challenges such as deciding what to include in an ethogram, how to record data, what the best sampling methods were, and so on. Additionally, I learned that there were particular difficulties involved in interpreting data when it comes to animal behavior studies, and that there are many differing opinions on what the “best” way to do that are (Altmann & Altmann, 1977; Kramer & Schmidhammer, 1992; Bart, Fligner, & Notz, 1998; Wajnberg & Haccou, 2007). I feel that I need to do more research on this topic for future studies. Despite its many particular complications, I am still more committed than ever to pursuing research in animal behavior specifically.

Acknowledgements

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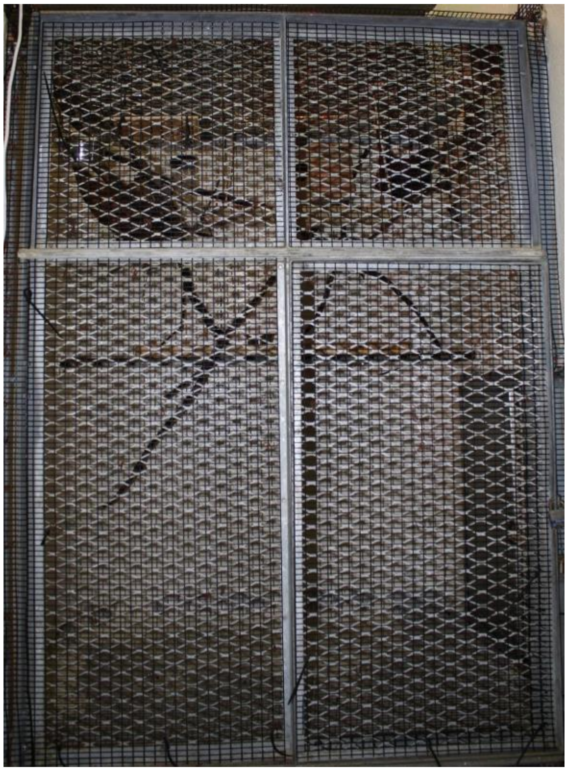
Appendix A - Exhibits

Exhibit #1 exterior (Exhibit #2 exterior very similar) and interior

Exhibit #1 features - nest box and artificial hollow log; nesting ball

Exhibit #2 interior and features (artificial log, branching, faux fur-lined hide triangle)

Substrate, ficus plant, and bottom of exhibits



Den enclosure exterior

Den features - hanging platform, nest box, hammock, branching, faux fur hide

Appendix B - Animals**


1.0 slender loris Kumar (Exhibit #1) and 0.1 Willow (den enclosure)


0.1 slender loris Vyvy (Exhibit #1) and 0.1 Yeu (Exhibit #2)

**1.0 slender loris Harold (Exhibit #2) not pictured.